ENGINEERING HERITAGE AUSTRALIA

ORAL HISTORY PROJECT

TRANSCRIPT OF INTERVIEW WITH

MARK BUSH

Interviewer	Doug Ayre
Transcriber	Mary Macfarlan
	History Development Pty Ltd
Date of Interview	12 April 2017
Duration	2 hours 7 minutes

NOTES TO THE READER ON INTERPRETATION OF THIS TRANSCRIPT

Readers of this oral history transcript need to be aware that it is a near verbatim transcript of the words as spoken during the interview that was conducted in the form of a natural conversation between the interviewer and the person being interviewed. Some changes have been made to facilitate the flow of the document.

Much of what is said in such interviews relies upon the accuracy of the memory of the person being interviewed and readers should bear this in mind and judge for themselves how factually accurate the material is. The interviewer has sought to clarify or verify facts and statements made during the interview where this seemed appropriate.

The views and opinions expressed within the transcript are those of the person expressing them in the interview.

Please refer to the notes on the following page to aid interpretation of the transcript.

Note 1

The recording runs for a total of 2 hours and 7 minutes.

Note 2

Where the interviewer has used words such as 'Yes', 'Right' or 'OK" as an encouragement, but not as anything else then these words have not been transcribed unless they are relevant for the context. Commonly used habitual phrases have also been deleted from the transcript.

Note 3

The interviewer has inserted occasional words (which are not in the original recording) into the transcript in order to clarify the context of what was being said. These words are shown in the form [they would say].

Note 4

Where a sentence has a series of dots in the text such as …… this indicates that the speaker paused, the recording was not clear enough to transcribe accurately what was said or the following speaker interrupted what was being said.

Note 5

The interviewer is referred to as 'DAA' in the transcript and to the subject speaker is referred to as 'MB' as appropriate.

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INTERVIEW TRANSCRIPT

Track	Speaker	
1/00	DAA	My name is Doug Ayre. The date is the 12th of April 2017 and I'm interviewing Mark Bush for Engineering Heritage Australia. Mark, could we start with your family background please?
	MB	Yes. I grew up in Victoria in a couple of towns south of the city of Melbourne - Frankston and Sandringham. Frankston's at the top end of the Mornington Peninsular, which was a little bay-side town when I was a kid there but is now a large city. My mother is Victorian, or was Victorian, and my father came from New South Wales. But there's a Western Australian connection through my mother. Although, apparently, she was born in Melbourne she spent the first couple of years of her life in Geraldton here, which is where her mother came from. But she was taken back to ..... her mother married a Victorian fellow and was taken back to..... she was taken back to Victoria to live in that state for the rest of her life so that she is effectively Victorian. An aunt of mine did a bit of the family history or looked into the family history here in Western Australia. In fact, I didn't know anything about the Western Australian connection. My grandmother, my mother's mother, she was one of three Ward sisters, the Wards being a fairly old family here in Western Australia. There seems to have been some sort of falling out between Nona, my grandmother, and her sisters to the extent that there was never any mention of a Western Australian connection when I was growing up. Or if there was it didn't register with me. I don't know what the falling out was, maybe because she married a Victorian and moved over to Victoria. But when my wife Fiona and I came here in the 1980s we discovered that there was a large sort of group of fairly distant relatives - but relatives nonetheless - here and my aunt who did the history research into the family history arranged a meeting. So, we went along to a family gathering, walked through

the door and there was a massive room full of multitudes of people. They were all related to me [and I] had no idea.

The family names are Ward [and] Green and various others that are well known here in Western Australia. Names that rang a bell with me because they're the names of students I'd been teaching. So, it was quite probable I was teaching my distant relatives without realising it.

DAA Probably just as well?

1/03 MB Yes. Well, the story about the Wards is that the Ward name - in that family alone - at least, began in Western Australia with the arrival of William Francis Ward in the 1860s from England with his wife Elizabeth Ward who was prior to that Elizabeth Raleigh, and I do remember my mother saying that we possibly had a connection to Sir Walter. But Sir Walter Raleigh was around some 300 years or so before Elizabeth Raleigh so I'm sure there was plenty of time for the Raleigh to propagate in various directions. We've been unable to confirm any sort of connection there but it was a story, probably just because of the name.

Now he, William Francis Ward, became the governor or the head [warder], or whatever the appropriate name is, of the Rottnest Island prison. I'm sure he did the job expected in the day but current times it was not such an auspicious role to be running a prison for Aboriginal people. They then went to Geraldton and he became the head warder at the Geraldton goal, which is where the Geraldton connection comes in.

Fiona and I went to Geraldton a couple of years ago to track down a bit of that history, and we did find his gravestone in the old Geraldton cemetery. His wife Elizabeth Ward, nee Raleigh, apparently lived into her 90s and became a very well-known character around town, was also buried in the same cemetery but we couldn't find her headstone.

On my father's side, my father, as I said earlier, grew up in Sydney.

He was born in Sydney and grew up in Glebe, an inner-city suburb. In Glebe Point Road in fact, and his father Herbert was also born in Sydney, but Herbert's father, John James Bush, came from Devizes in Wiltshire. He was in his early 20s as far as we can tell when he migrated and the only member of the family that migrated. There was always a whisper of some kind of scandal. We couldn't - we can't - determine what actually went on but you can kind of imagine the conversation between his father and John James along the lines of 'son it will be in your best interest and the family's best interest if you move to Australia'.

DAA Move the colonies, yes.

MB Something like that.

DAA Well him and many thousands of others maybe?

MB Yes. There was a story of him being a bit of a rogue as was his son, my grandfather. He had a bit of a reputation for being a scoundrel to a certain degree. Fiona and I went to Devizes a couple of years ago to see what we could find out about the Bush family there, and we encountered a family of Bushes living in Devizes, and they had been there for some time. We thought perhaps they're our relatives, and we made contact with a member of that family that had plotted their family history and we compared notes. Fiona having a background in archaeology and history has done quite a bit of research along these lines, so we were able to compare notes, and it turns out that that family of Bushes was moving into Devizes in the early 1900s just as my line of Bushes was leaving the area, so they didn't cross.

Bush is a fairly common name. It's an old Saxon word that literally means forest or copse and when the Saxon names were being handed out people that lived near the forest were tended to be called the Bushes.

DAA Right. Yes.

MB The name was assigned many, many times, so it's quite common

particularly in southern England and around Wiltshire.

We found the grave of his father in the one of the church cemeteries still in its original position in Devizes. Also, from what the research we were able to do [told us], the family business was sort of mixed. It was jewellery, watches and printing, but we did find the store - the actual building that was used as a family store and accommodation for part of the time there at least.

DAA Right.

MB Yes, John James came to Sydney or went to Sydney and married a lady there who became my great grandmother. Gave rise to Herbert and then to Ron Bush who was my father. And there's a kind of a naming mystery in the family. My middle name is Beaufoy which is intended to mean beautiful faith in old French. It's pronounced more like Boofoir (*phonetic)*. [Some] pronunciation like that but in modern French, apparently, it means something more like 'pretty face' but the intention is 'beautiful faith'.

DAA Yes, indeed.

1/08 MB So, my name is Mark Beaufoy Bush. My father is Ronald Beaufoy Bush, my grandfather Herbert Beaufoy Bush, and the story is that the generation just before that there was several brothers - one of whom became a monk and moved to a monastery in France and thereafter those brothers gave the name Beaufoy as a middle name to their sons down the generations. We can't really confirm that. We can't find any story or any evidence of monks or monasteries associated with [it].

DAA You wonder whether it was the name of a monastery?

MB It could have been. However, we did find that the first use of the name was the generation just before my great grandfather and it was a girl, so we don't quite .....we can't quite work it out but, in that generation, there was a young girl child who died as a baby, and maybe there's some kind of connection there in honour of that girl ...

the name was given to her first and then to some sons.

1/09 DAA Yes, as you go back into names in England you've got the Anglo Saxon, you've got the Danish influence, you've then got the Norman influence, apart from the Scots and the Welsh and the Irish as well and, if you came from the west country and the south west, you had a strong Celtic influence coming in from France. So, we were very much a mixed bag.

MB Very mixed bag.

DAA But the names are fascinating, aren't they?

MB They are, aren't they?

DAA Yes.

MB But the Beaufoy line stops with me. I have an older sister and brother who both have male children, and they didn't use that name. Although I can't complain because my brother gave, as the middle name, to his first son Mark in [my] honour I assume .... and I didn't have a son - a daughter but not a son. The tradition stops there.

1/10 DAA Alright. So, family background then? You basically came over here from Victoria?

MB Well no, directly from New South Wales - from Sydney.

DAA New South Wales – Sydney?

MB We had move around quite a bit. I actually went to university in Queensland to gain a Bachelor of Engineering there, then moved to Sydney to do a PhD, and stayed in a college called International House, University of Sydney, and met a girl there named Fiona. We got married shortly thereafter and we're still married. But we came across here from Sydney. Directly from Sydney, as she's a Sydney girl, for a job at the University of Western Australia.

DAA You touched on tertiary qualifications there. Tell me a bit about your tertiary education then.

1/11 MB Well, as a child and teenager my parents [had] moved backwards and forwards between Victoria and Queensland. I went to a whole range of different primary schools for example. But at the time that I was finishing high school we were in Brisbane - or in Beenleigh, a town south of Brisbane roughly half way between Brisbane and the Gold Coast - and I was going to the Brisbane State High School which was the first really good school I went to actually.

I was a fairly mediocre student generally but going to that school - which was a very high-quality school - great teachers that turned me around. I don't know how my parents got me into that school incidentally. I don't know what they said when we moved to Brisbane to get [me in]. It's a school situated in the city and we lived way down near the Gold Coast so it was a lot of travelling involved for me as a student.

Anyway, we were located around that vicinity, so my first university was the University of Queensland. I went there to do a - actually I've +always had a life-long interest in wildlife and nature biology so I actually went to the university of Queensland - enrolled in a Bachelor of Science with the intention of majoring in zoology, but fairly quickly realised that zoologists find trouble getting employment, but engineers don't. I did do well in science and maths and [was] very fond of technology and so forth so switched to engineering and majored in mechanical engineering there at the University of Queensland.

Graduated with the University Medal, which is one of the top awards the university gives, and then moved to the University of Sydney to do a PhD. I decided fairly late in my undergraduate career that I really did like the spirit of investigation - discovering new things, which is research basically - so wanted to pursue a research oriented career. No real thoughts at that stage whether it would be in a university, or a research lab, or private industry, so that meant a PhD. I wrote at the time to mechanical engineering schools around the

country. University of Melbourne, Sydney, and various other places although at that stage I hardly knew anything about Western Australia so UWA probably didn't feature at that stage. Although with ..... given my interest in wildlife, I did know of Kings Park. That was the only thing I knew about Western Australia - that there was a Kings Park and it was a beautiful representation of the natural bushland.

But I wrote to various heads of school in the different universities and got positive replies from most, but one very positive reply from a fellow named Roger Tanner in the University of Sydney, who offered to fly me down there to take a look at what they were doing. Which I did. I took up that offer, went there and met he and his group and the rest of the people in the school and just felt that was the place for me.

So, I went to Sydney to continue my studies at a PhD level, which was focussed on fluid mechanics and, in particular, [a] focus on polymer rheology - which is the way modern polymers flow - which is related to plastics manufacturing processes. Upon completion there, I stayed on for a couple of years - 18 months to two years - as a post-doctoral researcher, and by that stage had decided that I really did like teaching as well as research. So that meant heading towards an academic sort of career.

DAA Yes.

1/15 MB In those days - this would have been the early '80s - this was before the rapid expansion of the university sector in Australia, there were very few academic positions. They were like hen's teeth, but two came up about the time I was looking. One at the University of Newcastle and one at the University of Western Australia. The Newcastle one was in civil engineering, but it was engineering mechanics which is what I had been studying, effectively. The equations were all the same it's just the applications are different and the other here in mechanical engineering. I was shortlisted for both. I missed out on the Newcastle one. They decided that they'd best appoint a civil engineer - who's a fellow that I grew to know in later

years. And I didn't get the one in Western Australia either.

This was shortly after Fiona and I were married and we hadn't had time for a honeymoon. So, we decided to have a honeymoon at that stage and went to Fiji for a week. But about that time, I got a phone call to say they would like to offer me the job after all because the primary candidate turned the job down in the end. And beggars can't be choosers so I said 'okay, we'll come across.' And that's how we wound up here.

It turns out that the fellow that was offered the job initially came to the department at a later time and we became good friends.

1/16 DAA What year was that?

MB 1984, in August.

DAA And you've been here ever since?

MB Yes.

DAA So, you've settled in Western Australia then?

MB There were chances to leave but we decided not to. I've certainly lived the longest time in any one place here.

1/17 DAA It's amazing how time flies too, isn't it?

Let's just take a step back. You mentioned schooling and you mentioned that the first school that you really connected with, I think, and I was tempted to say that good teachers make the difference, don't they?

MB Mmm

DAA But you also mentioned that you moved around a fair few primary schools so, was that related to your parents moving around then or [what}?

MB Yes. I could tell you a bit about my father's background and that might help explain things?

DAA Mmm, please.

1/18 MB He, well, my parents were both fairly young [when] the second world war commenced and they were married during the war. They met each other apparently at a dance in Melbourne. But my father had trained as a signaller in the Royal Australian Army - Royal Australian Signals - I actually have his war record. There's a lot of 'marching in' and 'marching out', which means he went to various places. But towards the end of the war he was stationed in Darwin, and was undertaking a lot of training in electronics and signals. He was apparently - what I heard from one of his former colleagues then - was that he could transmit Morse Code really cleanly and quickly, to the extent that they thought it was a machine sending it.

He was a very good signaller and he was obviously studying a lot of electronics which..... towards the end of the war which would suggest he was being trained to repair equipment in the field. My mother always told me that he was part of Z Special Unit, which is sometimes called Z Force, which was a commando force. It was harrying or hassling the Japanese forces in the islands north of Australia, and that there was a big offensive being organised for Singapore, and that he was part of that. We could never find any evidence of this and his war record doesn't specifically mention Z Special Unit but he was there in Darwin which was the advanced position for this unit - particularly the signals section - and undergoing all this training so it, sort of, ties in.

And he was there when Darwin was bombed several times and so it, sort of, connects together, but we couldn't find any direct evidence.

DAA Mmm.

1/19 MB Anyway, his background was signals electronics. He became part of the ABC after the war and was involved in the transmission, or setting up the transmission, for the 1956 Olympics in Melbourne - and also was there helping bring in the era of colour television in Australia in the 1970s. I actually have a photograph of him standing in front of a colour test pattern adjusting all sorts of dials and knobs and so forth to

get it perfect, as he always did. A real perfectionist in sound and vision.

But, so, it's his connection to the ABC that led us to move around a bit. He was initially with the ABC in Victoria but when I was in - I'd moved a couple of schools there in Victoria - but when I was in about Year Five or Six, I would imagine I think it was about that time, he moved, or they moved, to Queensland associated with the ABC. But my sister was quite a bit older than me, was already married at that stage and living in Queensland, so I think that possibly had something to do with it as well, and we moved to Ironside which is close to St Lucia, which is where the university of Queensland [is], which is ironic [because it was] where I wound up later on after another couple of moves.

School there I thought was terrible. It was the Ironside State School or Primary School and I remember actually being belted with a stick because I was getting mathematics wrong - which I thought was a great way of teaching. And I don't think it worked out very well for my father either, or my parents, so we were all generally unhappy. So, we moved back to Victoria and that's when we wound up in Sandringham rather than Frankston, and I went to the Sandringham East State School. I do have some memories of that school, and subsequently moved on to the Highett High School, which was also nearby. It wasn't such a good school by reputation and [I] didn't do so well there but, actually, it was there where I started to cotton on to science and maths. I recall being a sort of a regular 'C student' in maths and suddenly maths seemed to make sense and, you know, I flipped into 'B's and 'A's just before we made another move back to Queensland, which was when my father retired from service - the ABC service.

So, I think things were probably starting to gel in my mind about that time and Brisbane State High School really cemented it well.

DAA Yes.

1/22 MB I remember saying to a science teacher at Brisbane State High School that I thought I might like to be a teacher. He said 'no, you don't want to be a teacher. You can be an engineer or a physicist [so] why would you want to be a teacher?' I still remember him - his name was Ray Skyrene - he was a physics teacher and he was very inspiring, actually.

DAA Okay. How did you spell his name?

MB I really can't recall but 'Skyrene' was the pronunciation so it was probably phonetically 's k y' perhaps?

DAA Alright so, what year were you born then, Mark?

MB 1958.

DAA 1958. So, you did mention that you had a very early interest in basically natural sciences, didn't you?

MB Mmm.

DAA Have you sustained that in any way?

MB Yes absolutely. I think that probably came from my parents. They were very much outdoors people so we always had ..... and gardeners, my mother in particular loved the garden, my father too, so there was always gardening going on you know. A love for plants and birds and animals and we'd be out in the bush in Victoria quite regularly.

DAA Right.

1/23 MB And I think that probably instilled it in me because at quite a young age I was keeping birds, building aviaries myself and keeping finches, attracting birds to the garden by setting up the right environment for them and providing nectar - honey water mixtures - for the honey eaters to come in. And that's always..... I've continued that throughout life that interest, and Fiona has similar interests fortunately. When we go travelling we tend to combine a wildlife component of the trip with an archaeology component of the trip. But,

in fact I have very large aviaries now still at home in the hills here in Parkerville, and finches and quail and parrots that live in there - live their lives surrounded by bushland effectively inside these large aviaries [and that] continues.

I've developed quite a - or early on developed - an interest in photography of wildlife and that was probably [due to] a fellow named Vincent Serventy. He was a naturalist - well known naturalist - in the early days in Australia.

DAA Yes, that's a familiar name.

MB Mmm, and those sorts of influences led me into photography - still photography in those days- and actually I recall doing paper rounds and chemists delivery rounds to raise funds to buy cameras.

DAA Yes indeed.

MB And that's continued now but more into video photography. I carry large amounts of video equipment around with me when I'm hiking now and make short videos, voice overs, and the works.

DAA You'd have started your photography in the days of film?

MB That's right, yes.

DAA As I did of course.

1/25 MB Yes, and the biology link was wildlife and biology generally because, as I said I was planning to be a zoologist at one stage, but professionally continued that sort of interest as well. In the latter years of research I've focussed on biomedical engineering which has brought that interest back in another way.

DAA You mentioned having an interest in teaching - much to the horror of one of your teachers by the sound of it?

MB Well he was thinking in terms of [being a] school teacher, you know.

DAA Yes, of course. So how did your teaching career develop then?

1/26 MB It probably grew more out of my PhD days, because PhD students

tend to do to run tutorials and laboratory sessions and the odd lecture or two. And having in my own interest in a particular technology or science phenomenon, for example, requires a lot of thinking and understanding - and checking this and checking that and 'why doesn't this work' and 'why does that work'. And there's a lot of effort required to develop that deep understanding of some phenomenon or mechanism, and I found it was really pleasing to be able to impart that sort of body of work to students to help them get there a bit quicker than I did for example. I really enjoyed the tutorial work as a PhD student and that led me fairly late in the piece to thinking in terms of an academic career.

DAA I know having done a limited amount of teaching myself I soon realised that if you didn't really understand your subject then your students were going to see right through you, weren't they?

MB Mmm.

DAA So, I'm assuming on that basis that with your background in research that that complemented your teaching?

1/27 MB Mmm. I remember .... I have a really strong memory of one particular occasion in a tutorial. It would have been a computer science tutorial of some sort because it was a piece of computing code the student was having trouble with. It was only 10 lines but it was producing the wrong result. He couldn't work it out. I had a quick look through it and I could see immediately what the problem was. It was just one of those little logical errors that quite often occurs in coding where you can't see it unless you actually think your way through the code as if you were the machine actually running through it. And I said' oh your problem's just there, you know, it is that needs to be an 'i' instead of 'j' or something like that. And he said 'you know, I've asked five or six people and nobody's been able to tell me what the problem is'. And that's great, you know, so just in a matter of minutes, I helped the student a great deal and I've got a really strong memory of that and it's a sort of pleasure that [happens].

DAA Yes. You get a real buzz out of it, don't you?

MB Yes.

DAA Alright. And having had a career in teaching do you still have an interest in teaching?

1/28 MB Yes. I don't do teaching ..... I haven't taught formally for quite a while because I undertook more senior management roles at the university. But I'm involved with volunteer fire fighting now and I'm a team leader which means I'm in charge of training groups of fire fighters from all different walks - all different backgrounds - because we're volunteers. So, I maintain an interest in teaching.

DAA Yes.

MB I'm actually working on a schematic of the pumping system on our heavy tanker, because nobody seems to understand it, and when I first appeared I'd asked people 'what this does [and] what that does?' and you'd get five different answers so nobody really knew.

I've been spending some time under the truck following the pipework and making a schematic so that I can present this to the team to help them understand why they flick this switch here and that switch there to get water there. Because if you wind up in a situation that is slightly unfamiliar, it's the understanding of what all this does that gets you through the problem.

DAA Yes. I always remember when I was doing my own engineering degree that I was taught by a very wise man who said 'Always understand the basics. Get a good grasp of the basics and you'll be able to deal with anything else.' And I've often thought about that because I've used that advice and it certainly paid off.

MB Mmm.

DAA Yes. Sounds like you have done too?

1/30 MB Yes, the fundamental ..... if you fall back to the fundamentals you can always think your way through a problem - and in the firefighting

situation it's particularly critical because you haven't got time to think in a great deal of detail but if you understand the basics you can work your way through a problem.

You might be seconded to an unfamiliar truck for example on a fire ground and you've suddenly got to operate all the equipment and if you're not sure ..... if you know that the switch up here on the right on your truck is what you flick to get water, but you're faced with a different panel, but if you know what the switches do you can work out how it operates.

DAA Yes.

MB On one occasion operating down at Waroona last year [during] big fires down there that destroyed the town of Yarloop - I was operating down there for three days using a Department of Parks and Wildlife heavy tankers, which is an unfamiliar piece of equipment to me but we were filling up from dams, and we backed our truck down to a dam where another truck had already been parked and these guys were sitting there trying to work out how to pump water out of the pond into the truck because it was an unfamiliar truck for them and they had the fittings the wrong way around and it was leaking air and so on. But the fellow I was with and I both have a fairly good understanding of the equipment and we were able to problem-solve their issue [and] tell them - show them - what was wrong and set it up correctly, because we both understood the fundamentals. My colleague was a professional fire-fighter of many years and he really knew what to do.

1/31 DAA Yes. So, the principle is sound then - understand the basics?

MB Absolutely.

DAA Okay. You mentioned coming to WA. Now, you will have held various positions here then so would you just talk me through what happened to you after you took your first appointment here in WA and how you progressed through?

MB Well one of the first things that happened was when I was moving into my new office - I was about 26 I think when I came across here, as a ....

That's a half hour is it?

DAA Yes, I'll just do a stop there.

2/00 DAA You were 26, yes?

MB Yes. When I first came to WA we were both 26, Fiona and I, but moving into my new office there as a new young academic, this tornado came through the door in the form of a fellow named Michael Norton, who said 'oh it's great you're here, we're going to do great things' and then the tornado left again. Michael died several years later from leukaemia and I think of him from time to time and he was my first memory of the department here when I arrived. A very energetic fellow.

But people like he, sort of, encouraged me to keep at various roles as a young lecturer. So early on I was focusing on the teaching I was required to do and winning research grants and getting research projects under way and so forth as academics do. A bit of industry connections too - a bit of consulting for industry. But in the ..... well I found that I didn't actually like doing the same thing all the time so I tended to undertake different roles as I could, just for interest sake [and] a bit of variety.

I maintained teaching and research but I'd do quite a bit of administration as well because I found I quite liked helping people do their job. As a result, I wound up being appointed the Head of Department in those days - in the late '90s - and that was a time when a new course had been introduced - materials engineering - so there were materials engineering staff and mechanical engineering staff in the traditional mechanical engineering school. Materials was growing quite rapidly and there was kind of a bit of a rift between the two branches of the school.

Sorry, I use the term ‘School’ which is a modern term, but it was a ‘Department’ then. The name of the department at that stage was Mechanical and Materials Engineering. So, it was a slightly divided school - department - and the Dean at the time asked me if I could - or he appointed me - feeling that I was the best person to try to draw the different parts of the department together. I was actually seen as a Materials Engineer, even though my background was mechanical, because I worked with molten plastics, which were materials. I was starting to work on composite materials, which are solid materials, at that stage as well.

I had quite a bit of opposition actually from my former mechanical colleagues to me becoming the Head of School, but overcame that pretty soon after being appointed and I think we became a much happier consolidated group after that. I also became the Deputy Dean towards the end of my time as Head of School. I didn’t actually - you know - it wasn’t something I sought, it was something I was asked to do, so I had a few sessions of acting Dean while the dean was away and as a result I was the acting Dean when the Dean finished with his contract and moved on.

I was involved in the appointment of the replacement Dean. I had no interest at that time in becoming the Dean, largely because I had just landed a large research grant and I was uncomfortable with the thought of having the responsibility of running this research program while being the Dean. But it took a long time to - well it’s a long search for an appropriate person as Dean - and quite a few interviews which fell through and no appointments were made.

I was the acting Dean for about a year and, in that time, I became comfortable with the fact that I could run the research program while being the Dean so I - with a bit of arm twisting - at least I eventually consented to apply for the job and went through quite a rigorous interview process despite the fact that I was the only applicant at that stage and they knew me. I suppose they had to be sure that they

followed the procedure correctly and I was appointed the Dean. Now that would have been in 2003.

DAA Of course, the corollary of that is that you knew them as well and that helps, doesn't it?

MB Yes. I actually had the same role, in a sense a general role, in that the faculty was somewhat divided at that stage. It was a faculty of Engineering, Computing and Mathematics so we had a couple of the sciences attached to us as well, not just Engineering, which were like different universes and not interacting very well. My brief was partly at least to unify the faculty. One of the things I did was to create the first strategic plan the faculty had ever had, which focussed on 'one faculty', and made some strategic appointments in the Dean's office. My Deputy Dean for example was taken from the Mathematics School and also a woman so that I was tackling two issues at once making it clear that mathematics is part of the faculty and that women have equal status as men. In fact, at the end of my time there, men were the minority in the faculty office. I was one of only two in a faculty group of about 10 people running the faculty.

DAA Yes. And competent people to boot?

MB Absolutely. Yes.

DAA Yes. You strike me that you – really, I'm not sure whether this is the right term to use - but you really became a change agent? A champion of change probably. Is that fair comment?

2/06 MB Yes, that's true. [It] followed on after I was the Dean actually.

If I could continue that story a bit. I finished as the Dean after six years. I was under pressure to renew my contact but I decided I wanted to do other things. There were other aspects of life that I wanted to pursue in career as well as outside. In fact, I had quite a deal of study leave accrued so I took a period of a year of break after being a Dean to catch up on a few things, but during that period the Vice-Chancellor approached me to ask me if I would chair a very

difficult departmental review. He wanted a former Dean to handle it because he wanted somebody that could put up with bullshit basically.

DAA Philosophically of course?

2/07 MB Yes. And this was to do with the use of animals in research, which is a very touchy area in any university.

It was like a war zone at UWA. The management of the animal facilities was vested with the administrative part of the university. It was under funded [and] the researchers were not very happy with the service and so on. And so, the Vice-Chancellor decided that he'd commission an external review with an internal chair - which was me - and just do whatever the review said. He probably regretted that comment because we had some rather difficult recommendations as a result.

There were three people external to the university from RSPCA, and a couple of other research facilities around the country, and me as the chair. I think he might have asked me to do it because he knew that I had an interest in bio-medical research, although my research didn't involve animals directly it's that general area.

We sat for six days, which is the longest review I've ever been involved in. I've done a lot of these reviews. And [the review] wrote some rather difficult recommendations about relocating the facilities, and management of the facilities, and removing certain people here and there. It wasn't acted upon for some time because I think it was so difficult.

But around about that time I had applied for and actually landed the contract to be the Director of Physical Sciences - I think it was the right term - with the Australian Research Council [ARC] in Canberra, which was quite an attractive position for me to take on at that time. But Fiona was doing a PhD here at Curtin University at the time and we didn't really want to leave Western Australia, so I would be living in Canberra and she'd stay here, so there'd be a lot of travel

backwards and forwards.

I did ask the CEO of the ARC at the time if it would be feasible for me to spend one week per month in Perth, working from Perth, and she put it to the public service which was running the ARC at the time and they said 'No, no, no'. I mean, their attitude is that 'if you're not at your desk you're not working' which is just crazy. And that was probably the deal breaker for me, but there was another factor in that I had just again landed a very large research grant and I would have to relinquish it, because it was from that organisation, to avoid perceptions of conflicts of interest, and I could see ways around that because the CEO would simply manage that project from the administrative perspective instead of me managing it.

But again, the public service - in Canberra - wouldn't go for that so even though I had the contract ready to sign I said 'no, I won't sign it'. So, I was looking around for something else to do at the time. I was going back to research and teaching but happy to do other roles.

Going back to that review of the animal research facilities, the Vice-Chancellor said 'okay' I'd like you to become what was later known as the Director of Animal Research Services, in a new division within the university which reports directly to the Vice-Chancellor [dealing with] management of the facilities, and moving into that section.' And then appointed me as the Director to rebuild the morale in the staff within that centre, fix its budget problems because [they were] running a big deficit each year and various other things. So basically, 'you could implement the recommendations that you wrote in that report'.

DAA And if you'd only known in retrospect?

MB Yes, I would've gone a bit easier on [the recommendations].

DAA But what a challenge?

2/11 MB Yes, it was. But I actually find that was one of the best things I did in the end. It was really difficult because, although it wasn't my

decision to move the management of the facilities, it was effectively taking away a large amount of territory from another part of the university. So, I became 'Public Enemy Number 1' to a certain group. I'm sure they 'unfriended me on Facebook' pretty fast.

DAA Well you've got to get lucky sometimes?

MB It made operating very difficult, but the staff - there were around 30 or 40 animal care staff plus the manager -they were all very happy with this because they felt somewhat down-trodden in the previous arrangements. We worked through their budget - I actually did calculations like 'how much does it actually cost to keep a mouse in a box for a day' and proposed to the university a different funding structure which basically involved the university funding the basic infrastructure with the researchers themselves paying for the cost of keeping an animal in a box for example.

That meant a substantial increase in the budget for the animal care facilities, which came about, [and] the budget came into the black just as I was finishing. This was a four-year task. It was always intended to be a limited task, so I was more or less setting them up to hand them on to a new manager within the university, which ended up being the faculty of medicine, which is a more natural place for them to be at that time at least.

But, you know, just building up the confidence in the staff - the morale - building the morale up again and particularly in the manager of the facilities at the time so that he could manage properly. I found that a very satisfying job. Very stressful but very satisfying.

DAA Well it brings me back again to what I said earlier that you were a champion and a change agent weren't you and having a champion for a group like that is inestimable really isn't it?

You know, it's just crucial really?

2/13 MB Mmm. It is.

DAA Certainly, politically sensitive because they would have lots of people

[who] would be prepared to criticise them of course?

MB Mmm. A lot of the clients of the facilities were the medical research people for example and you always had this feeling that some professors in engineering thought they were God but in some other parts of the university they know they're God.

DAA Yes. We won't go there. Alright. So, you were involved obviously with the animal facility research facility? What happened after that?

2/14 MB That brought me to 2013 which was when I was 55 and I decided to leave the employ of the university at that stage and to pursue a variety of other things, which is called 'retirement' by some people, but I don't use that word. I just say that I no longer take a salary from the university [but] everything else is the same. I've always had a lot of different interests outside the university as well in various organisations. A lot of volunteer work and work with professional organisations associated with engineering and science.

DAA Okay, is there a little you'd like to tell me about that?

MB Well over the years - well actually I checked recently my longevity with Engineers Australia, because I'd actually forgotten when I signed up - and it turns out that it was 39 years ago. In fact, as of a few days ago, it was exactly 39 years ago when I signed up as a student in Queensland. So, I've been a member that entire time.

As a student of course, I thought I might be an engineer in industry and signed up then to gain the benefit of being a member of the organisation, but for academics - and even today it's true - it's not such an important thing to be a member of Engineers Australia because the organisation is focussed on professional engineering practice. A lot of academics do that of course but the bulk don't. But even so I decided to stay .... remain a member after I came to Western Australia, more as a sense of responsibility to support the profession, so my subscriptions will continue to support the profession and I became actually involved in the operations here in Western Australia

fairly quickly.

I think that started with a committee called the Engineering Education Committee or something like that because of my academic background I was part of that. Wound up being an elected member of the Board of Management for the Western Australian Division and in fact President in 2011, which is a really good [but] very stressful year. It's a big ..... it's a very onerous job to be a President of the organisation, while you're doing another job full time. But really satisfying. I really enjoyed it. It was the year - that was the time when the organisation had theme years - and that year was the Year of Humanitarian Engineering, which was a particular interest of mine.

During that year I wrote a lot of newsletters, articles and so forth about humanitarian engineering and what's happening. I also did quite a bit research on pro-bono work - how different companies around town are handling the pro-bono situation, because it's not part of the natural environment for engineering to do a lot of pro-bono work in the way it is in law for example. But some companies are doing that and doing it in a really positive way. But others are trying to get into it – 'how do you do it' sort of thing, so I collected together stories from different companies on how they're doing pro-bono work and presented that as a guide - 'this is what sorts of things that you might consider'.

DAA Mmm.

2/17 MB And I know a number of companies actually took that away with them and I think that it had a positive influence on them. During that year, I spent a week in the Solomon Islands as a guest of the Australian Army to see what the reserve engineers are doing up there, which was great. I really gained a very positive impression of our reserve forces while I was there, incidentally. A great bunch of young professionals from all walks of life. There were engineers, and there were nurses, and doctors, and professional administrators from government positions, all working there together to help the Solomon Islands

government.

2/18 DAA Yes, I certainly had that experience in the UK. I was in the army reserve for a number of years and you had this broad range of professions - in an infantry battalion really - but you could scale that up with all the skills and knowledge that you needed to anything really.

MB Mmm. Exactly.

DAA Fascinating bunch, aren't they?

MB They are, yes. My opinion of the armed force really rose. I had the same opportunity in the same year to visit Garden Island here, which is the naval base to see what the reservists do there as well.

DAA Good.

MB We had an internal tour of a Collins submarine, under high security, and saw the torpedoes down in the forward torpedo compartment. [It] was a great visit.

DAA Yes. Good. So, having ceased to take a salary from UWA then what do you do with yourself now?

2/19 MB Well I continue this connection with Engineers Australia. As just one example - continuing that story in more recent times - I became a member of the Board of Accreditation, which is a national accreditation board associated with Engineers Australia. I'm still on that board and do quite a lot of work associated with that. In the last couple of years I have been in the United States quite a bit reviewing their accreditation system. We're all part of an international club called the International Engineering Alliance which affords cross-accreditation of degrees, so that a graduate from an American accredited system ... university, their degree is automatically recognised here so they can gain accreditation from Engineers Australia quite quickly because there's no need to assess their qualifications in detail. But to remain a member of that club each accreditation system has to be reviewed every six years, so my task

was to chair a review of the American accreditation system and decide whether they should be allowed to continue as a member.

Being a foundation member of the organisation, I was sure they would have passed, and they did pass with flying colours. I did something similar for Malaysia just recently. Malaysia want to become a member of the club and they need nominators from two current members, and they had asked Australia to nominate them, so I was sent to Malaysia for a week to asses all their documentation, their processes and observe a couple of their accreditation visits to determine how well they're doing but they - I was really impressed actually - they're doing it a very high standard. So, my recommendation was certainly to nominate them.

DAA There would be some challenges though in that area?

MB Yes. Oh yes.

DAA You know, internationally?

MB Certainly yes. I was given two good countries to visit. There are some difficult ones coming along.

DAA Yes, I can imagine.

2/21 MB I'm also an elected Fellow of the Academy of Technological Sciences and Engineering, which I'm very proud of actually because there are only around 800 Fellows in the country, so it's quite an honour to be elected to such an organisation. I was elected in honour of my contributions to the design of dental crowns, which is part of the biomedical engineering I spoke about earlier.

DAA Really?

MB Yes, and very quickly fell into administration in that organisation. So, I joined the local Western Australian Division committee quite quickly and found myself chairing that for a couple of years recently.

DAA Tell me a bit about designing dental crowns then?

2/22 MB Well the bigger picture is, as I said earlier, I've never wanted to do the

same thing all the time so that applies at a sort of micro-level as well as macro, so that within research I've moved my interests quite a bit. The basics are the same but the applications are different. My PhD studies and early research here in Western Australia were to do with moulding of plastics, which is fluid mechanics.

I then moved on to composite materials, which were aluminium - ceramic reinforced aluminium - alloys which are used in engines and various other applications which at that time seemed to hold a lot of promise. But hasn't worked out so well because they break quite easily in various circumstances, but at that time I was actually developing simulation methods to actually track a crack through a composite material.

The material is reinforced with these hard, ceramic, particles which are either fibres or small particles - discrete particles - and as a crack runs through the material it weaves its way around these hard particles or might even go through them, and I was developing modelling techniques that could track these cracks so we could estimate or predict the strength of the material effectively. And I bumped into some people in the - just trying to think of the name - the National Institute of Standards and Technology in the United States, in Maryland, who were working on teeth. Well, crown dental crowns at that stage which undergo fracture.

A dental crown will often fail because the cement that's used to glue it onto the remains of the old tooth will fail, but quite often dental crowns just fracture all of a sudden so the owner of the crown might not be chewing on anything hard or particularly tough at the time but it will just suddenly go 'crack'. I'm sensitive to this now because I now have two crowns, which are only recent. But, at that time, I didn't have crowns. So, there was a large project established, or funded, by the National Institutes of Health in the United States that was looking at all aspects of dental crown design - the materials used, the cements used to glue them on to the remains of the old tooth and

the fracture mechanics.

But they didn't have anybody that could handle the fracture mechanics and through this connection through NIST, which is the National Institute of Standards and Technology, we became - effectively in Western Australia here - my little group became the only non-United States component of that big project. And, very pleasingly at the end of probably seven or eight years of the research program the industry partners, which were the dental materials manufacturers, said that the most significant outcomes in that whole project was [by] the Western Australian group because we could understand why they fracture, and that was the connection.

I was doing this fracture work in aluminium, or ceramic reinforced aluminium, and they said 'oh, hang on, can you do can you model these cracks in other types of composites such as crowns which are a composite structure? There's a core of a certain material and a coating of porcelain which forms the aesthetic hard coating'. And we said 'yes, sure' and so we started making …… doing modelling but also experimental work where we would make simplified models of crowns so we could put them in a lab and crush them and see how they fracture then use the simulation technique to predict the strength and compare the two and adjust the simulation technique so it became predictive. So that's how I wound up working with crowns.

DAA Mmm.

2/26 MB Later the same question came from evolutionary biologists who said 'we have teeth from hominid ancestors that have cracks in them and if we give you a tooth with a crack - that's so big - can you tell how much force that tooth was subjected to?' Because that can tell them something about the bite force capability of the animal and from that, you know, by extension something about their lifestyle and foods and so forth. And we said 'yes, can do that'. It meant a change in our modelling technique to handle the different materials that are in a natural tooth compared to the ceramics that we were dealing with, but

we were able to predict fracture of human teeth really quite accurately. We could use human teeth because there's quite a bit of experimental work on the fracture of human teeth and we did our own work as well - crushing teeth.

We were able - through the NIST connection - we were able to lay our hands on [to] wisdom teeth drawn from US marines. They donate their wisdom teeth before they go into operations because they don't want to have to have teeth problems in the field, so they've got jars full of these teeth that are extracted from the US armed forces. So, with the appropriate approvals and so forth we were able to use those teeth to do experimental work compared with the model.

So, we started predicting bite forces in hominid ancestors for the [evolutionary] biologists who were at Marshall University in the US at that stage - sorry, George Washington University - and we moved on to looking at the fracture of fangs on Smilodon.

DAA Yes.

2/27 MB Smilodons are sabre tooth cats [that] lived until about 10,000 years ago, which helps explain how they used those teeth. The problem with a long, curved fang –the thought was that the animal would use these fangs to bite into the neck of the prey which was possibly mastodon in those days - large elephants or young versions of them - and then hang on. But we were able to show that the tooth is actually very fragile. Because it's so long and slender it can break quite easily and we were able to actually calculate those break loads and it meant that the tooth was very fragile. If a tooth fractures, whether it's a fang or a molar, then the animal's in real trouble because it can't process food.

And it led to the understanding that, together with other evidence coming from other directions, that these animals didn't just pounce on their prey and hang on for dear life while they were running around madly. They were probably attrition hunters - that is they would chase the animals until they fell over from exhaustion and then they

would pounce and use their fangs, because the fangs really had to be protected.

DAA And was the fang used to kill?

2/28 MB Yes. There's evidence in - a lot of these animals lived around what is now California - and most of the fossil evidence has come out of the La Brea Tar Pits and preserved very well [because] the animals fall into the tar pits and are preserved. And you can see the damage to bones in the mastodons, and other vegetarians at the time, caused by these fangs.

DAA Fascinating.

MB Mmm, and that was the most interesting work I ever did actually in the latter part of my research career. There's the [biology] - coming right back to evolution biology which is one of my core interests in life.

DAA Indeed, and your natural science interest really?

2/29 MB Mmm, mmm.

DAA Yes, interesting, isn't it? I mean I've often thought that we start off doing engineering and then your career and work evolves into all sorts of fields which you would never have imagined when you started off.

MB Yes, exactly. But coming back to your question about what I do now. I don't do much [with] the university at all - so I have all these other interests. There's the Academy, Engineers Australia [and] Engineering Heritage is another aspect of Engineers Australia that I work on now.

DAA Yes.

MB The Fire Brigade takes a lot of my time. I'm a team leader and crew leader which means that I'm responsible for training people and organising training operations. I have one coming up on Saturday actually that I'm working on now, and so even when there are no fires it still takes a lot of my time.

DAA Yes.

2/30 MB I really enjoy that too. It's a completely different activity compared with the rest of the previous life. The reason I joined the brigade is that we live in the hills where there's - you live in a fire risk all the time - and for 30 years, basically, I drove down here to Nedlands, 40 kilometres away, working on my career [and] relying on somebody else to look after my house if there was a fire. Since leaving the university I work almost full time out of my home office, so I'm there, and I thought it's time for me to start protecting other people's houses while they're down in Perth working on their careers and that was the motivation. But the payoff is that it's a great pastime.

DAA Yes. Well it's not only a great pastime but it's a serious business, isn't it?

MB Yes. Yes, oh yes. Very stressful.

DAA It's a real business, isn't it?

2/31 MB Well, when you're a crew leader you can wind up - or you're responsible for the crew of course - so when I first started I was dragging hoses, spraying water, which was really what I wanted to do - just to be a dumb grunt, not have to make any decisions [of significance].

DAA Big boys' toys?

MB Yes, well. I've been making decisions and leading things for my entire career - I just wanted to be somebody that did something and didn't have to think about it. But as usual I pretty much quickly found myself in leadership positions.

DAA You and me both.

MB As a crew leader you basically stand around and make sure everybody's safe. So, you're directing people who are operating hoses and the pumps, watching for anything that could be unsafe.

DAA But as I said earlier it's a serious business, isn't it?

MB Mmm.

DAA I mean you're talking real-time real threats, aren't you?

MB Mmm. Absolutely. It can be very dangerous very quickly.

DAA Indeed.

2/32 MB But the other factor ..... I mean you play with great toys - helicopters and fire trucks and both Fiona and I are qualified 'priority one emergency drivers' so we can drive under lights and sirens, and we drive the heavy tankers, and it's fun. It's very stressful driving a heavy tanker though because you've got 13 tonnes and six crew on board and you're responsible - plus the public which is panicking around you.

DAA That's a challenge in its own right?

MB You turn on a siren and people do weird things. They either ignore you completely or they just do strange things to get out of your way. So, you've got to be very judicious in how you use the siren. You come to [traffic] lights and there's no way around - and there's traffic in front of you at the lights - you turn the siren off. You don't try to scare anybody through the lights.

DAA No.

MB But, yes, you get to play with great toys and so forth but one of the things I found most pleasing is that you're mixing with people from walks of life you'd not normally do. In Engineers Australia you're working with engineers. In the Academy you're working with other scientists, but here, you know, I work with - well there's one other engineer as far as I know, no, a couple of engineers on the brigade but we've got people who are grounds keepers, gardeners, electricians, plumbers, the whole gamut from professional to non-professional backgrounds. And we're all there for one purpose - to have fun and to protect the community - and so I really enjoy that.

DAA Yes. Okay we'll just stop there.

3/00 DAA Now there were other activities, Mark, that you were engaged in? Would you like to comment on those?

MB Well one of the fairly time-consuming activities that has recently arisen is a connection with the American Chamber of Commerce in Perth, which sounds like a fairly esoteric sort of connection, but the way it's come about is that that organisation - it's in Australia to encourage and facilitate business interactions between the United States and Australia. But it has in each state - each division, a committee called Women in Leadership, and the purpose of that committee generally is to support senior women managers, creating networks and so forth. In Western Australia, the CEO of the organisation here contacted a colleague of mine, Lyn Beazley, she's the former State Chief Scientist and a colleague of mine from UWA who I know quite well. Very energetic lady. She was contacted to become Chair of this Women in Leadership committee and Lyn decided that she wanted the committee to do something a bit different and so together they collected together a number of people to serve on the committee - mostly women from various businesses ... business type operations around town but Lyn also asked me to become part of the committee and in fact to be the deputy Chair of the committee because she knew of my background as a Dean [and my] support for women within the university - within the faculty.

And, so, the committee .... the new committee as it was formed - came to the view that okay we want to have a bigger pool of senior women to choose ... or a bigger pool of candidates for senior business leadership positions, which means growing the fraction that are women, and how do we make sure that we have a bigger group of women to choose from? We've got to keep young women in their careers. Women tend to leave their careers, no matter what profession, at much higher rates than men. They go off to raise families and don't come back because the opportunities to come back are not there or they haven't sorted out the impact of the break on their superannuation and so on. Various reasons [such as] rigidity in

the business that doesn't allow part-time work - that type of thing.

But these things just, sort of, continue to be barriers to women, so we thought rather than try ..... there's a lot of activity in the area to try to reduce those barriers and facilitate the continuation of women in their careers. We thought it might be better to try to prepare women for these inevitable career interruptions and that meant giving them some basic knowledge about superannuation and insurance and managing finances and life events preparing for life events. Knowing something about what taking time out to have a child would mean to your career .... and the women on the committee are both young and older but they're all senior women in business and they would say that they were not prepared for this sort of thing in their lives and that they would've loved to have that knowledge in advance.

So, what the committee has done is created this organisation called 'The Financial Toolbox' which is a series of workshops directed initially at least at young professional women. Six workshops focussed on those sorts of aspects that I've just spoken about - superannuation, finances, insurance, taxes, budgeting - that type of thing - basic financial skills that everybody needs but not too many actually have. And we've been running those workshops now for about a year and they've been highly sought after and they're running well. We're now starting to repeat them.

It's all done by volunteers. We're all volunteers. The people that organise or develop the content for the workshops and present the workshops are also volunteers and they come from organisations such as the accountants' institution - I can't think of the right word - CAANZ is the acronym for them. The Chartered Accountants Australia and New Zealand that's right and also the Company Directors' Institution. They are supporting it by providing the facilities, providing the people that come and talk ... and the presenters will come and give case studies - you know, this is what a particular person has experienced and because they had this insurance

they were able to continue paying their mortgage while they were recovering, or this is the sort of preparation somebody did for taking time out of work to have a child and to work part time while that was happening - just to get these sorts of concepts into the minds of young women so that they're better prepared. It's been very popular and we've extended the concept now to try to help women who are in, or facing, homelessness or in domestic violence situations and are often in refuges.

We've connected up with a couple of refuges to see how we can bring these same skills in to help them, either by providing the same sorts of workshops but tailored to women in the sort of situations they are in those circumstances or in one case to train a set of trainers within the refuge who can then talk to the women directly. We've also started developing concepts for extending these workshops out into rural areas [where there are] a lot of issues particularly in farming communities around these same sorts of questions [like] what is superannuation, what do I need to do?

DAA Yes.

3/06 MB It struck home to me quite recently when I heard a fellow fire fighter around the fire station asking people if he knew who he could talk to about superannuation to get it started - and he's older than me. So, he hasn't even .... he's still working and he hasn't really focussed on superannuation at all in his entire career so if he'd known what he should be doing when he was young he'd probably be in a much better situation.

DAA Yes. You touch on the issue of women and domestic violence. This is something I always connect with this because I came from a family background which was violent in that my father was not a very pleasant character. But it strikes me that it's becoming worse. Have you got a feel for that?

3/07 MB None of us are .... have a background of working in the refuges so we're connecting to the refuges now and learning about what happens.

But it seems there seems to be quite a bit linked to [the] economy, so people that are suffering financially tend to ..... tends to trigger violence quite a bit. But there seems to be a lot of psychological issues associated with it as well. I was hearing about a situation where a fellow takes the wheels off his car each day so his wife can't go anywhere. That's not normal. I mean there's a psychological problem.

DAA That's called being a control freak.

MB So, with the refuges we're focussing on how to help women in those sorts of situations.

DAA Yes.

MB How to keep your savings separate so they can't be [taken].

DAA Yes, safeguard you own interests?

MB Yes. The bank will allow that to happen but most people don't know to ask the question.

DAA Well things have changed a lot in that respect as well haven't they over the years, of course?

3/08 MB I offered - talking about this wheel removal case [but] not with the person involved of course - we were being told about it [so] I was offering a wheel return service. I'd come along every day and put the wheels back on.

DAA Oh dear. That wouldn't be without its risks?

MB No, certainly wouldn't.

DAA Just touching on the business of bush fire control again have you any thoughts on climate change and the impact on that?

MB Oh yes, definitely. Whatever the reason that the climate is drying in the south west here, despite the relatively wet summer and the winter we've just had, I'm sure next year we'll be back to the normal season - the normal trend of drying, the rainfall has dropped [in amount] enormously over the last 50 years in Western Australia and so it was probably a trend that was happening anyway and human activity has

simply accelerated it.

DAA Yes.

3/09 MB So, it means that you have shorter non-fire-risk regions and shorter winter regions - periods rather - when there is little fire risk. It tends to mean you get quite a lot of material growth - vegetation growth - during those wet periods in winter which means there's regular fuel supply, but longer dry periods which is when the fire risk occurs. And it means there is a compressed period in which we can do control burns to control fuel levels because you very quickly find in spring you can start doing control burns as it starts to dry out but you very quickly find you're suddenly in total fire ban situation because it dries so fast.

DAA Can happen within days, can't it?

3/10 MB Yes, so you're not able to control the fuel levels as we used to because the time simply isn't there to do it. And the drying conditions mean the fuel is much more explosive.

DAA Yes. My wife and I have a five-acre bush block north of Toodyay up on the ridge. It's beautiful piece of bush and we've had it quite a few years but after Easter we'll be up there we've got 10 or a dozen trees down which have got to be cleared. We're quite ruthless you know. We get that out of the way and clear the fire break and make sure everything's 'A OK'.

And every year you do it and my neighbour's property he's never touched it and if a fire ever goes through that ……?

MB Yes, well a lot of people don't realise that the fire brigade can't be everywhere at once and they're not going to be at a place they can't defend.

DAA No.

MB I've been in major fires - houses burning - and you triage them. You know, this one, the fuel's been cleared away from the house, it's defendable [but] this one next door the fuel's right up to the walls and

just leave it because you don't put yourself at risk.

3/11 DAA Yes that's [right]. I say to my wife we must not put the fire brigade people at risk.

MB Yes, well, they won't put themselves at risk.

DAA No, but we mustn't. even inadvertently, you know. But sometimes you do look around you and you think 'Oh my God'.

MB I recall a big fire in Parkerville a couple of years ago that I was one of the first responders so I was there when houses were exploding and gas bottle exploding all around us.

DAA Terrifying.

MB But I remember triaging houses along a particular road, and the fire hadn't yet reached that position, and we were picking this one and that one - that one we can defend - and we stayed and looked after those and just forgot about the others. Coming back hours later [there were] empty blocks where the houses were that we couldn't defend and we had to leave. But pleasingly the houses that we had done some work on were there. So, the moral is that the owners have a big responsibility.

3/12 DAA Yes. I remember many years ago, as an engineer, talking to a bunch of people and they said 'how do you deal with an emergency?' and I said 'don't have one.'

MB Exactly.

DAA Sound advice?

MB Yes.

DAA Alright. Let's move on now.

You talked about involvement - or you touched on involvement - with Mineral Research Institute of WA I think. Would you like to explain a little bit?

MB In fact, that's another major activity that I carry on now. As the Dean

of Engineering ..... there was an organisation, a government organisation, called the Minerals and Energy Research Institute of WA – MERIWA.

DAA Yes, I remember that.

3/13 MB And its committee - advisory committee to the board - which is a committee that looked at research grant applications, was a representative committee …….so I was on that committee as the Dean of Engineering at UWA and there were other people from other universities as well, plus industry. Two years ago, the decision was made to remove the 'E' because over the last several years a different organisation had developed called the Energy Research Alliance, which is a different type of organisation. It was a private one rather than part of the government, which was really looking after oil and gas so we took the Energy out of MERIWA and made it MRIWA - Minerals Research Institute of WA.

DAA That's why I said 'I remember it' because I knew the name had changed.

3/14 MB It was an opportunity to completely redesign the organisation. A new board was established and a new committee structure for advising the board, which was no longer representative so it was people put on ..... selected because they were people with certain knowledge rather than representing certain organisations. I had finished being the Dean at that stage so I assumed that I would not be involved any more, but one day I got a call from the newly appointed Chair of the Board, which was Peter Lily, who I knew from way back. He was the Director of WASM - the Western Australian School of Mines - while I was the Dean so I had quite a lot of interaction with him then and he asked me if I'd chair the main advisory committee to the board and I said 'oh well. you know I'm not Dean anymore?' He said 'oh no, no, we want you because you're Mark Bush not because you're the Dean'. They were the words he used.

DAA There's hope for you yet then?

3/15 MB Yes, so I must have made an impact. And so, it was quite a good time because - this was now two years ago - so everything was new. My committee was new and so I was involved in setting up its terms of reference and mode of operation and selecting people for sub-committees. We have four or five sub committees that look at different aspects of projects that come through. There might be a project in exploration, there's a certain sub-committee that looks at that in detail, and they're really subject specialists.

Another one in mining and equipment and this and that. So, the subject special sub-committees look at it first and seek assessors' reports and so forth and then refer it to the main advisory committee which then makes a decision about it and then refers it to the board for the final decision of whether to fund it or not. I chaired that for a year and then had a tap on the shoulder again to become a member of the board.

So, after just setting up the advisory committee I left it to become a member of the board and that's been the case for the last year - about a year ago actually - early last year I became a board member. So, my roles changed and rather than looking at the technical detail and determining whether the project is worthy from that perspective it's more the big overview as a board member to decide whether, you know, a budget can afford it and whether it fits in with the broad strategic objectives of the organisation.

So, I'm a non-executive director on the board, which takes quite a bit of time. But I really enjoy it again. Always have [enjoyed] that role. I'm not from a mining background, but mechanical engineering which is a big part of mining.

DAA Indeed.

MB I understand the geology and the machines and the management of engineering operations and so forth. But you get to see just how much

really innovative research and technology development is done in Western Australia through this board. The board [in] the way it works [is] that the board projects will be put to the organisation from research providers like the universities and CSIRO, but with a very large industry component, so we expect the industry partners to be providing at least twice the funds that the state government provides through MRIWA. It's very much industry oriented [and] very, very practical and there's really great stuff done in Western Australia in that field.

DAA Mmm. Yes, I spent four years in Kalgoorlie. Say no more. I got used to swallowing dust and looking at holes in the ground.

MB Yes.

DAA My son's there to this day. Works for the Super Pit.

MB That's a big hole in the ground that one.

DAA Well indeed. We'll talk a little about that off the record.

So obviously mineral research is significant here in WA but it would have a national and international role as, well wouldn't it?

MB Yes. I think in WA we're doing world class and world leading research, and the sign of that is that a lot of the companies that buy into the projects here are international companies.

3/18 DAA Right. Now, you mentioned Engineering Heritage which of course is one reason why we're here.

MB Mmm.

DAA What do you do with that? What's your role with Engineering Heritage?

MB I'm a member of the committee for Engineering Heritage. I had to pause there because the name has changed slightly [to be] called Engineering Heritage WA - EHWA. The way that came about is that I was on the board of management for the division at a time when some sort of anniversary was coming up for the organisation - I can't

recall what it was now, maybe it was 90 years for the WA Division and I had also been involved with the Engineering Excellence Awards which are awards given to current engineering projects. And at the board meeting I suggested well, as part of this celebration of the history of Engineers Australia in WA, why don't we identify some projects around the state that are not the Engineering Excellence projects but are projects that have been done in the past that have had a big impact on the local community or the state in general, and write a short summary of each. And we can put those reports in each of the newsletters that come out through the year as a kind of a celebration. And I volunteered to do it. And within a day I found myself being contacted by the Chair of EHWA - I wasn't actually very aware of that committee at that time - who was Don Young.

DAA Yes, I know him well.

MB And, so, I found myself a member of that committee very quickly. My idea for these little reports never happened but I became part of the committee and involved in the heritage recognition program there and within a year or probably a bit more I wound up as the Chair of that committee for three years.

DAA As you do?

3/20 MB Yes, and I finished that a couple of years ago but stayed on the committee. So, I'm still doing the occasional Engineering Heritage recognition project which means you choose a project, or a site, or an object, that is really quite significant from an engineering perspective - research its background and write a report or nomination to the national committee for heritage recognition, which can be at a local level or a national level or an international level depending upon the significance. I'm still doing that.

Currently on my agenda I have the lighthouses - Leeuwin Lighthouse and Cape Naturaliste lighthouses as a combination - as part of the Engineering Heritage for navigation around the State to do this year at

some stage.

DAA Right. Yes.

3/21 MB But I've previously been involved in the Carnarvon Space Tracking Station for NASA. It's now an empty field with concrete foundations, but it was the most significant tracking station in the NASA network - outside of Goldstone in California - and it played a key role in the Apollo missions in particular, because the reason Carnarvon was chosen is that it's diametrically opposed to the launch site in Florida which means that the rockets when they're launched from there achieve their maximum altitude over Carnarvon. And so, a tracking station was needed there to correctly track their trajectory, so that on the next orbit they can fire the boosters and boost out of earth orbit to the moon.

So, Carnarvon relayed all those instructions to send them on their way to the moon and also welcome them back because they'd re-enter over Carnarvon and so that was the first tracking station to pick them up upon re-entry. So, it's really quite important and not many people know about it, because it's that type of project.

DAA No.

MB And so, the idea is to raise in the eyes of the public the role of engineers and some of the engineering history of the country.

DAA Well I'm biased and I wouldn't suggest you are but I mean engineering is so important to modern society, isn't it, and it's very rarely recognised as such?

3/22 MB Yes, exactly. I had a self-interest in a project a couple of years ago now [which] was the railway deviation up Greenmount Hill to the east of Perth.

DAA Oh yes.

MB The original railway in the 1800s went up the south side of what is now the Great Eastern Highway, but it was designed for small locomotives and small loads but as the agricultural industry developed

beyond the hills the loads got bigger and bigger. There was one particular bend at Boya which was referred to as Cape Horn by the railway workers. They'd get derailments there quite regularly.

So, late 1800s the government decided to find a deviation around that difficult section which led to a new railway line being built up on the north side of what is now the Great Eastern Highway, through the John Forest National Park. Which was how the park came about, because the railway line was there and people could see the beautiful scenes and thought it would be a good place for a national park.

It also led to the development of communities like Parkerville, Hovea, Stoneville. I live at Parkerville so there was a bit of self-interest in this one. So that was awarded an engineering marker.

DAA The railway - I would say easement but it's probably not the right word - is no longer a railway line I presume?

MB Oh no, no. In the 1960s it was pulled out. It was the line through to Adelaide, but in the 1960s the standard gauge railway - the new standard gauge railway from Adelaide to Perth was completed and it comes in through the Avon Valley and winds its way around the base of the hills to Midland rather than going up straight up the hill from Midland.

3/24 DAA Yes, I know that well because you've got the old tunnel haven't you opposite John Forrest?

MB Mmm. The path, the route, is still there [but] the rails have been removed but the route is [preserved]. It's called the Railway Heritage Trail and the tunnel's there. It's still the only tunnel in Western Australia - rail tunnel - other than the trenched and cover type ones that were built on the network here more recently.

DAA Well they don't count.

MB Yes. [It is] the only hard rock tunnel you might say.

DAA Yes.

MB And the original .... one of the original wooden bridges is still there too but it's underneath an embankment. It became a little bit unstable and I think it was the 1920s when they built an embankment over it to stabilise it so you walk across this embankment without realising the original bridge is still under there.

DAA I think I know the embankment yes, yes. So, there's a bridge underneath that then

MB Mmm, it's just to the east of the Visitor's Centre.

DAA Yes, okay.

3/25 MB The point I was making there was that the impact that engineering has on the community. All those communities along there were suddenly able to thrive because of the railway, which was due to the engineers that put it in.

DAA Yes. Well, as we were saying over a cup of tea, I lived in Kalgoorlie for four years and my son is still there and of course Kalgoorlie and the Goldfields and engineering [are] second to none aren't they because the place wouldn't exist without it?

MB Exactly, yes.

DAA Yes. So, it's always been fascinating really. I mean the Goldfields' water supply of course is the classic but the railways and the roads and the power supply are all fundamental, aren't they?

MB Mmm. So, as you walk around town you'll see information panels - interpretation panels - set up against bridges and like the Narrows Bridge, Causeway Bridge, various buildings, up there in the hills at the railway site and dams.

3/26 DAA Mundaring Weir, yes?

MB Yes, and they're all put in by us, EHWA.

DAA Yes. Okay.

So, over the years you will have come across many people. Have you

found any in particular that were, or are, significant to you?

MB Been an influence? Oh yes, there are a lot of people throughout my career that have influenced me in one way or another, mostly positively, but there are some people that are fine examples of not what to do.

DAA Well that's true, isn't it? I mean you learn from that too, don't you?

3/27 MB Exactly. But I think one of the first really ..... actually you know - I mentioned Ray Skyrene, that physics teacher that said 'you should be an engineer or scientist'. It's probably - I hadn't thought of him until I mentioned it earlier today - he's probably one of the first influences in that sense. But the greatest influence I think on the way I worked as an academic was probably Roger Tanner, my PhD supervisor in Sydney.

His mode of operation was to give people a lot of leeway so you'd meet with him about one a week and talk about what you've done and where you're going and he would suggest doing this or that and then you don't see him again. He was not a hands-on supervisor and I, consciously or subconsciously, I don't know, copied that style. I found it very useful because it gave me a lot of leeway to do what I felt I needed to do and then go back for advice as I needed it rather than being led all the way. And I copied that style one way or the other, and I've had quite a number of PhD graduates of my own that [became] very independent people as a result.

There was one student who was very difficult in the sense that he came from a background where he was told exactly what to do [because] outside Australia his culture was do what you're told and he could not do anything on his own. You know, he had to be told - told what to do and we ended up terminating his candidature.

DAA Which is a tragedy really, isn't it?

3/29 MB It is yes. It was just - we tried so hard. I was a co-supervisor - this was in the field of dentistry - the main supervisors were in dentistry

and I was the materials supervisor but I ended up becoming the main supervisor towards the end because everybody gave up on him.

We had a kind of a big committee of people, including people that look after PhD students in the university, to try to help him through multiple conferences with him to explain you've got to [think for yourself]. 'Okay you've done this experiment and you got these results - what does it tell you - where do you go?' He doesn't know. He just couldn't get his head around it, but he came to us with quite a lucrative scholarship from his home country.

Anyway, other than that I've had quite a number of excellent PhD graduates who are now professors in the United States and Australia and work as consultants in industry. One works with the CSIRO, working on biomedical matters, so I've tried to engender that sense of taking ownership for what you're doing.

So, Roger was probably a fine example of that for me and influenced me quite a lot.

DAA Okay, we'll just stop there.

MB Alright.

4/00 MB Locally, career-wise, I think Alan Robson would be another example. Alan Robson's always been around at UWA while I was [there].

DAA Well-known name, yes.

MB Yes. He was the Deputy Vice-Chancellor when I first became the Dean so I reported directly to him. But then he moved on to become the Vice-Chancellor and Deputy Vice-Chancellor at the time was Margaret Sears so she was my boss as the Dean for the remainder of my time as Dean. But both of those together actually I thought were fine examples of senior leadership in a university, being supportive but giving you the leeway to make mistakes - basically you make mistakes. It's something I carried forward to my days looking after the animal facilities, because I had the manager of those 40 staff under my wing and he was in a situation where he was afraid to make

decisions because in the past everything [that] went wrong was his fault but anything [that] went right was never attributed to him. And so, I actually told him several times 'I don't mind if you make mistakes. Make decisions and make mistakes so long as you fix them, that's all that matters.

DAA Yes. And you learn?

MB Yes. And I think Margaret and Alan had that view, you know, that's the way they tended to operate as well.

But outside the university, my parents were obviously a great influence. They were an influence in terms of the broader interest in wildlife and nature but neither of them were from a professional background in a higher education sense. My father [was] a television technician, my mother was a secretary, and my older brother and sister followed non-professional types of careers as well. But I was obviously more academically minded and my parents gave me great support all the way through doing it and [with the] encouragement and support - they'd do anything to help me get through those university years and so forth.

But even broader than that I mentioned Vincent Serventy.

DAA Yes, you did.

4/02 MB I didn't know him personally, he was just his ..... his interest in wildlife and the way he did it. He actually published a couple of my photographs and stories. I once wrote a story about how I provide food for the honeyeaters and photographs of them, and he published them in his newsletter. And I sent him at one stage some fairly unique photographs I was able to take of a massive moth called an Emperor Gum Moth - it was about that big probably for people listening [that is] about 15 centimetres in wing-span - emerging from its cocoon. I had these snaps of it in all the stages and I sent them to him. Didn't hear from him for ages but eventually I got a call saying 'could I use your photographs in the magazine?', so probably that sort of activity -

his activity - and those opportunities that led me into wildlife photography.

DAA Mmm.

4/03 MB But more generally I remember as an 11-year-old sitting watching the Apollo 11 moon landing in my grandparents' house in Rosebud around on Port Phillip - south of Port Phillip Bay - and really just being fascinated you know that this ..... we could put people on another planet.

DAA Absolutely. And do you know what fascinated me - and I did the same as you and watched it - what fascinated me was we could see them and hear them.

MB Yes, yes and not realising at the time that it was Australian tracking stations play a bit role.

DAA Yes, you know the drama of that was [incredible]. I was in UK at the time and there it was on a little TV screen you know. Amazing.

4/04 MB Mmm. It played a role in my interest in technology.

And Carl Sagan was a great influence ..... his program and book Cosmos, that just really sparked up my fascination with the universe and science, and understanding science in simple terms.

DAA Cosmos. Yes, I remember that. I had his book Cosmos and I lent it to someone and it never came back. I know why. It's very good.

MB And David Attenborough would be another. I actually watch his programs with an eye to seeing how they did the photography and try to emulate it in many ways. I've built a lot of mechanisms to track the motion of animals and so forth to produce the same sorts of shots, involving little rail tracks and what the movie industry call 'dollies'.

DAA It's interesting isn't though, Mark, because you bring a broad wealth of experience and knowledge together to these various interests, don't you?

4/05 MB Mmm.

DAA And you take probably take it for granted but the synergy of those things is greatly enhanced, isn't it?

MB It is, yes. You bring knowledge from different [disciplines] together.

Speaking of David Attenborough, I was actually contacted by his unit in the BBC a few years ago, asking if I would appear on a program talking about rain forests.

DAA About rain forests?

MB Yes, and I thought this has got to be a scam of some sort. It came from a young lady - or I didn't know she was young at this time - but a lady from his unit, the Natural History unit. So, I did a bit of internet research looking her up and found that she was a young lady, but she had won a competition set up by Attenborough, the prize being to work as an assistant in BBC Natural History unit for a year or whatever. And she was tracking this fellow Mark Bush who could talk about rain forests.

I knew that it wasn't me she was after because when I do a citation search on my research papers I come up with a whole lot of papers to do with forests, wildlife, animal biology, and so forth by Mark Bush - there's another Mark Bush in the United States. So, I wrote back to her and said that I'd love to but I think you were after a different Mark Bush and he's the one - I think he was in Florida somewhere. And she wrote back and said 'oh, thank you very much. We found him'.

But the curious story with that is that when I first discovered this fellow [and] I have trouble separating my papers from his - because it's exactly the same [name of] Mark Bush - and a lot of mine are in biology oriented areas too so you couldn't necessarily separate them by content. So, I started using my middle initial 'B'. Mark B Bush to identify my papers. This was many years ago now. He obviously had the same problem because he started using his middle initial. You know what it is?

DAA 'B'?

MB ‘B’.

DAA How did I guess?

MB So, I still come up with all of his papers. I bet his middle name is not Beaufoy?

DAA No, I bet it isn’t. Oh dear, that’s Murphy’s law, isn’t it?

We were talking about people that have been significant so have there been any others?

MB Well many others [and] a lot of my colleagues are great examples of things ….. I think they would be the main names that come to mind as influences and, you know, when David Attenborough passes on it’s going to be a tragedy.

DAA Well, and it’s coming closer isn’t it as well.

MB Yes, yes.

DAA But you are right.

MB I sense though that he’s set up a really robust unit there that will continue the tradition.

DAA Let’s hope so.

4/08 MB Not that there’s much left to do. He’s covered about everything there is.

DAA He seems to have done an absolute wealth of work doesn’t he but nevertheless I’m sure there will be things. I mean, I look at the exploration of the earth and you always think, you know, we don’t know the oceans, do we? So, to me anyway that’s where it’s going to be. But then again you read regularly that new species have been discovered?

MB Mmm. Well Fiona and I visited the Natural History Museum in London a couple of years ago.

DAA Oh, isn’t that a joy?

MB Yes, which is where his offices are located. And it was just

fascinating. You read about all these fossils that are the key fossils in the development of our understanding of evolution and so forth and a lot of them are right there - the actual fossils. It was great to see them.

4/09 DAA Yes. It's been said to me 'well we always knew you would end up in a museum dad - you're an old fossil' and I said 'thank you very much'.

Career highlights then. What are they? I mean you've touched on them but just in retrospect what were the real highlights of your career?

MB Well there's a few at different levels there, because the career is teaching, research, administration roles. In research, I haven't had a chance to mention yet that ..... I mentioned it as a sort of change in focus of my research, but over those years there was also study leave.

One of the perks of being an academic is that they want you to go away for six months every few years to gain new experiences, so I did that several times. The first study leave was fairly early on in my career. That was to Belgium a place called Louvain-La-Neuve, which is the new Louvain - the old Louvain being further north which is now in the Flemish speaking part of the country - and the new Louvain is in the French part, deliberately to move the French speakers away from the Flemish speakers.

DAA Oh dear.

MB Well, apparently, there was a concern about this French speaking enclave at the university surrounded by Flemish, because the cultural border moved south basically, so they separated the cultures characteristic of Belgium. The Flemish and the …….

DAA Walloon, is it?

MB The Walloons, yes, the French speaking people, tended to have to speak with each other in English because they didn't learn each other's language.

DAA Right.

4/11 MB But that was a great experience. I worked there with a group that had developed commercial software for injection moulding and other types of polymer plastic flow, so I was able to help them tailor this commercial software in certain ways to make it more relevant to certain types of operations. That was great there living in a country - a non-English speaking country - or the Flemish speak English better [than] most Australians I think - but notionally a non-English speaking country.

The second one was at a place called Delaware, one of the states of the United States. The University of Delaware, and that was one of the best experiences I had. I had been ..... as part of this polymer work I was working on techniques to measure the velocity of fluid moving through channels inside a mould, for example, using laser beams. You can fire two laser beams into, say, an airflow. Where those beams cross, you can get a measurement of the speed of the airflow through the little volume of space that the two beams crossing over.

It's called Laser Doppler Anemometry and it can be applied to liquids as well and that is where I was applying it. And the people in Delaware had heard that I had a ..... I was asking around where I could go and a colleague mentioned me there, that they heard from him that I was using this technique and they said 'Ah, we've got this Laser Doppler system nobody knows how to use. Could he come here and set it up for us?' So, I spent six months there as a visiting professor at the University of Delaware.

[And so, I] spent six months at the University of Delaware pulling their system apart and adjusting it all and getting it all to work in the way that I had in Perth with our own system. And then set up some experiments and did some measurements and wrote some papers as a result of that visit. But I made some great friends there and had a good time living in Delaware.

The next one was even better. I became a consulting scientist at the Los Alamos National Laboratory in New Mexico, which is the place

that the atomic bomb was developed during the war.

DAA Yes.

MB It's a fascinating place. It's just a magic place. It's half way up an extinct volcano - or partially extinct - it still has smokers at the top. But it's a very remote location which was chosen for that for the Project Y within the Manhattan Project. Project Y was the component of the Manhattan Project that developed the explosive part of the weapon. It was done under top secret conditions so this town was created halfway up this volcano in a remote part of New Mexico, and it still has that characteristic. It's something like 30% - it became a national laboratory and does other things but mostly weapons oriented – 30% of the town have PhDs, for example.

So, it's a contrived society, but a beautiful place. It's above the high desert of New Mexico, which is a desert, but there are tall pine forests all the way up that volcano. In fact, Los Alamos means 'the big trees' apparently in Spanish,

DAA Oh, does it?

MB But that was great. I worked in a unit called 'Macro-Statistical Hydrodynamics'. I can't remember exactly what I was doing on that first visit but my office was located right next to an old nuclear reactor which was the reactor used by Fermi during the Manhattan Project to make enriched uranium. It was called 'Fermi's pile'.

DAA Yes, indeed.

4/15 MB So, there's that sort of history there.

And the second visit, which was a longer one, I was working in 'Weapons Materials and Manufacturing'. Not having a security clearance, I worked outside the fence in a holding area which is where all the Americans were waiting while their security was being cleared.

I was sharing offices with various scientists waiting to get their clearance and an air force pilot who was waiting to work with them as well. The lab was operated by the Department of Energy but he was

with the Department of Defence as a pilot - a navy pilot. He had clearance in the navy to operate and deploy nuclear weapons, but [for] the Department of Energy you had to go through the whole process again to get clearance to work inside the weapons lab so he was there as well. That was fascinating.

But what I was working on there was a very small part of a larger project - they had a problem with missiles - certain types of missiles - sea launch intercontinental missiles that occasionally the fuel would burn out through the sides of the missile. You'd launch it from the submarine and it would pop up above the water and then when the engine fired it would just explode - which was quite worrying.

DAA Would be if you were in the submarine?

MB Well yes. It was described to me that the missiles themselves cost tens of millions of dollars each but they were more worried about the billion-dollar submarine.

DAA Yes, I bet they were.

4/17 MB But it turned out to be a fault in the way in the way the fuel was loaded into the fuel tanks on the missile. The fuel is a gel containing small particles which is the propellant - the stuff that actually burns - and it's poured down into the fuel cylinder and as it flows down the side it produces what we call a sort of 'shear differential'. The fluid's been sheared in one part of the flow more than in another part of the flow and that forces particles to migrate. They migrate from the high shear region to the lower shear region, so the net result is that when a tank fills you've got these pockets of high concentration of fuel particles and pockets of less concentration and when the burn gets into a high concentration it burns faster and hotter and can actually blow out sideways, and I was helping the team there understand how that migration happens. Apparently, they solved the problem eventually by simply loading the fuel cylinders in a different way to make sure it was evenly filled so that the migration didn't happen. It will still

happen but it was happening evenly around the [fuel cylinder].

DAA In a controlled way, yes.

MB So that was one of my career highlights in terms of research I think. As I mentioned earlier the part of my research that I found most interesting is the more recent work related to evolutionary biology and the fracture of crowns. And I really quite enjoyed doing that. It was sort of the capstone experience of a research career.

DAA Yes, fair enough.

4/18 MB In terms of teaching what I often say when people ask me what my career highlight is, it's not anything I did in one go it's something I did more in little bits all the way through, and that is teaching generations of engineers. Because I bump into them all the time and they say 'I remember you, you were the great lecturer in fluid mechanics I had in those days. I still remember your lectures and they were great.' and so, you know, I played a small role in training the engineers that are building the infrastructure in Western Australia or Australia and the rest of the world, and my PhD graduates are professors and consultants. So, I always think my career highlight, the thing I'm most proud of, is those people that I've helped train because of the impact it's had.

4/19 DAA Yes, Indeed. Your influence is far reaching?

MB Yes.

DAA You didn't think it would be?

MB Unconsciously, yes.

DAA It is though, isn't it?

MB In fact, Fiona is currently working with a lady through the Heritage Office here - her husband was one of my first students.

DAA Really?

MB Yes. We've arranged a dinner shortly to meet [again]. He was finishing just as I arrived, but he says he remembers me. I don't

remember him.

DAA Right. Well I always used to say there's more people know me than I know them.

MB Ah, but in terms of roles, as I said earlier, I think the role with the animal facility was the most satisfying. It was really good to see the changes that occurred and just the change in morale.

DAA It certainly doesn't seem to be such a hot topic these days?

4/20 MB No, no or in Australia generally, it's not so hot. The UK and the US animal facilities are hidden away. I mean we have big signs up to say you know 'UWA Animal Research Facility' but they couldn't even imagine that - they'd hid them in basements and places like that.

But in WA in particular it's not such a hot topic I think largely because we don't deal with primates here. The Australian Primate Research Facilities are in the east.

DAA Alright. Now we've touched on your bush fire brigade experience. Is there anything you'd like to add to that?

MB No. I mean I could tell you stories of fire fights but probably not so relevant here.

DAA Yes, I'm sure you can. Okay, but that's ongoing though - your involvement, isn't it?

MB Yes.

DAA Alright, and we've also touched on supposed retirement?

MB Mmm.

DAA You're a bit like me I suspect?

MB Yes, exactly.

DAA You know, people say to me 'when did you retire?' and I say 'I'll retire when they screw the lid down on the box?

4/21 MB Well I often get annoyed at people who say 'oh, you're retired, why are you always so busy?' And this is often from people who .....

often through the fire brigade who are builders or plumbers or whatever and their view of retirement is you just stop doing everything and you just relax. And they don't understand the lifestyle of a professional who, you know, your profession just keeps going and retirement means you just taking a salary from somebody.

DAA Of course, it does. I'm exactly like you from that perspective.

MB Which is why I don't use the word.

DAA I just say 'I chose to do something different'.

MB Yes, yes exactly.

DAA Alright. There's a couple of areas I would just like to touch on with you. Have you had any involvement with bionics?

MB By bionics do you mean artificial …..?

DAA Well, sort of, artificial elements within the human body. I mean we talked about teeth obviously?

4/22 MB Yes, in a way. Well teeth directly of course - the crowns - and that's the work I was recognised for by the Academy. But from time to time I've done little jobs associated with instrumentation. Well actually one of them has been quite a long running one. I very early on connected up with a gynaecologist and urethral surgeon in Perth who is a real ..... he's full of ideas many of which are not physically possible, so it's quite a challenge to try to explain to somebody who doesn't have a background in physics and chemistry that why this is not going to work and why pressure behaves as it does and so on.

And so, it's been quite a long history of long discussions between us which has been very stimulating. He comes up with these great ideas and you've got to work your way around to something that's practical

DAA Yes sure. You have to do a reality check?

4/23 MB Yes, exactly. But his problem [and] the reason he first approached me is that he works specifically in the area of correcting incontinence in women which is often the result of child birth where tissues get

stretched beyond elastic limits and they don't recover. And so, he had this understanding of how the bladder and urethra actually work in both sexes but mostly in a woman. Which is a lot to do with [the idea that] you have your bladder which is just like a big balloon and you've got the urethral tube running from it - which is the tube through which it's drained. It's about four centimetres long in a woman a bit longer in a man of course because there's the external component as well. But the bit inside the body is the bit that controls the leakage, so the tissue around the urethral tube is elastic and it tends to close under its own elasticity. But that isn't enough to prevent fluid from leaking and he noticed that the geometry of the tube, when it's in relaxed state - when the bladder's in a relaxed state, is actually kinked and it's like taking a garden hose and kinking it to stop the flow and that seems to add an additional element of closure to the tube. And that kink geometry is maintained by the tissue surrounding the bladder and urethral tube. In a woman, the vagina plays a big role in that when the tissues get stretched. Then they have to [recover but] the geometry - the resting geometry - [has] changed and it can lead to, well, it's called stress incontinence. It means if you cough [then because of] the increase of pressure inside your body you might get a little bit of leakage.

And, so, he had developed an operation - it was actually a keyhole type operation rather than being in hospital for a week after the operation - it's day surgery basically where he goes in a put a strap, an artificial strap, around part of the structure inside the abdomen and around the urethral tube so that in the rest state that strap keeps it in a kinked position. And it was having an amazing success in how it operated.

But he was having a lot of trouble because it runs counter to the conventional thinking of how the urethra operates and people have whole careers on correcting the problem in the urethra by cutting bits of tissue out and wrapping it round the urethral tube to increase its elasticity and so forth so it forces it closed a bit more, which has

variable success. But that's been their careers and they don't like this other guy coming and saying well the mechanism you think is happening is not really there it's something else and I can fix it in a day.

DAA Of course.

MB But he ended up travelling the world teaching surgeons how to do that operation. So, it was very successful. But the problem was to correct part - the strap is one of the procedures but part of the operation is also to re-tension tissues within the abdomen. To do that you need to cut a piece out - a strip out of a tissue structure - and sew the edges together to re-tension it basically and he needs to know how much to cut out. And the way he did it was to press on the tissue with your finger like a probe to see how stiff it feels and think 'oh, I'll cut a centimetre out.'

DAA Yes. It's a bit arbitrary.

4/26 MB He was looking for a more precise way of measuring 'in vivo' during a surgical procedure [to determine] how stiff it is so [he could achieve] more [and] better repeatability. He had the right ideas but a really difficult problem.

DAA Yes, So, were you able to help him?

MB Yes, well, we developed some prototypes but didn't take it through to trials because he moved on. He's now in Sydney and the students I had working on that finished and I was unable to find more students at that stage. But we had various ideas of pinching - pinching the tissue. There was a sort of fat test you can do on skin where you pinch it and the amount it compresses [provides an indication].

That sort of idea - pinching the tissue - that's to be tested and it's the compression force required to compress it that tells you something about its elasticity. Or inserting needles, two needles into the tissue and stretching them apart to stretch it which is a more classical test for elasticity. We had prototypes developed for both types.

DAA Yes.

4/27 MB In fact, I mentioned one of my students works with the CSIRO in biomedical areas and that's the student that developed those prototypes. He was snapped up by the University of Melbourne pretty quickly to work on race horses, on the problems with their knees, and then wound up at the CSIRO.

DAA Alright, well that was interesting.

What about robotics? Have you been involved with that?

MB No, not really - only in a managerial sense, in that I had staff working on robotics under my [wing].

DAA I touch on all these things because I know right at the beginning you were a mechanical engineer, weren't you?

MB Yes. Well mechanical is a very broad subject.

DAA Oh. indeed, it is. Yes.

MB And my particular interest as a student was thermodynamics - fluid mechanics rather than machine dynamics.

4/28 DAA Right. Well I did an electrical engineering degree in the UK and, of course, we did fluid and thermodynamics as part of the basic engineering. And I always used to say if you need a transformer to operate under water at high speed under great pressure and temperature I'm your man. But I'm not sure now that I am but I did enjoy venturi flumes and things like that.

MB Yes, I know them well.

DAA Yes indeed. Alright well Mark I think that's covered it from my perspective. Is there anything you'd like to add?

MB I didn't talk so much about my role as a Dean. I mentioned that I developed the first strategic plan for the faculty which involved development of ……..

DAA Alright, just hang on a minute.

5/00 MB Do you want me to repeat what I just said?

DAA Yes please.

MB I didn't, speaking about my role as a Dean earlier, I didn't elaborate on some of the things that I had achieved there. I commented that my part of my role was to sew the warring factions - that were the faculty at that time - together into a more unified team which I think I did and people say I did. They acknowledge [that]. We developed the first strategic plan for the faculty which was focussed around unifying the activities and collaboration, cross-collaboration, in research and teaching and so forth.

But another thing that I did, I started [what] was really the first major fund raising - external fund raising - for the faculty. Fund raising at UWA was not a great activity at that time and although it had the odd bit of funds coming in out from industry supporters there wasn't - hadn't been - a concerted effort to fund a particular project. What we were wanting to do was to really improve the experience of students in the under-graduate courses because they tended to be left alone quite a bit and first- year students in particular found difficulties in finding their feet, understanding what the university and the course is about.

So, I made quite a few strategic appointments in the faculty office specifically to support first-year students and that involved developing space for them - space in which they can meet as student groups, to call home, but also to work professionally as engineers or engineering students - which means setting up a building that is like an industry work place, you know, like a design office in industry, in which industry sponsors can come in a talk to students about projects that they're running for the students.

The students can use the space for their interaction. Involved workshop space for them in the same building and so forth. So, we did quite a bit of fund raising notably with Harold Clough. He was one of the main donors and Monadelphous and we now have the

Monadelphous Integrated Learning Centre at UWA which is the sort of space that I was talking about there.

And since that time subsequent Deans have developed that and the university generally is focussed more on engineering. At the time, I was trying to raise funds there was a major campaign to raise funds for the business school and that locked out a lot of potential donors to engineering because they were being sought as donors to the business school. But after I finished as the Dean the university has provided a bit more focus on fund raising for engineering so that fund raising has continued and it's gone to much higher levels than I was able to achieve.

DAA I was going to say it's become more significant these days, hasn't it?

MB Yes.

DAA Yes okay. So, is there anything else you'd like to add?

5/03 MB No, I think that's it. There are lots of stories but they're the main activities and achievements I think.

DAA Yes, of course.

MB But there was one again a small thing which I'm very proud of and that is I've always had this focus on equity and opportunity and so I've consciously sought to support women academics in particular. But the university had - just the equity office - had just established when I became the Dean a support network for GLBTI people which is Gay and Lesbian, Bisexual, Transexual, Intersex and so forth. There a few more letters in that list these days but that's what it was.

DAA It gets quite complicated, doesn't it?

MB And I think .... I believe I was the first Dean to buy into this and I put a big notice on my door [with] rainbow colours that basically said GLBTI people welcome here;

DAA Yes.

5/04 MB And I learned and spoke about this at faculty meetings and [stressed

that] you know we need to be more flexible and support people who are our colleagues. I know that several of my colleagues were gay they [were] keeping it a secret amongst the general population but they're just our colleagues you know. And tried to get that message across to people.

But it was years later the Equity Officer mentioned to me that oh you know when you were Dean there was one of the academics in one of your departments [who] later came out as gay and attributed his confidence to do that to 'that Dean who had that sign on his door'.

DAA Really?

MB Yes. So, I'm really quite proud to hear that.

DAA Why not, Good on you. Alright.

MB I think I've run out of major stories.

DAA We've covered most things, haven't we?

Well, Mark I'd like to thank you for sharing all that with me.

MB It's a pleasure. I don't normally like talking about myself but [you managed] to get me going.

DAA Well you have to when you're doing an oral history.

Okay, well thank you very much.